



## King County EMS

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# CBT 536 Pediatric Trauma

## Course Supplement



# Intro

Trauma kills more children in the US than all other diseases combined. Each year more than 15,000 children are killed and more than 50,000 permanently disabled in traumatic accidents. The EMT's ability to rapidly assess and begin treatment for an injured child can have an enormous impact on the child's chances of survival and ability to recover.

Children are not just "little adults" and should not be treated as such. Their bodies respond to significant injury and shock differently than adult bodies. These differences may be subtle and difficult for the inexperienced provider to recognize. In this course you will explore these differences, how they present and how you can have a significant impact when caring for an injured child.

## Resources

The recertification exam for this module is based on a variety of resources. We recommend that you review the following:

Chapter 33 – Pediatric Trauma - *Emergency Care and Transportation of the SICK and Injured*, 8th ed.

King County EMS *Patient Care Guidelines for BLS* (10/02 ed.) pages 3.18-3.19 and 4.16.

This course also has a hands-on practical skills component.

## Objectives

CBT 536 is an EMT continuing education and recertification course. After completing this course you will be able to:

1. Identify the anatomical differences between adult and pediatric bodies.
2. Describe how shock is different in pediatric patients compared to adult patients.
3. Identify the signs of shock in a pediatric body and distinguish between late shock and early shock.
4. Identify the definitions of SICK and NOT SICK
5. Identify the three elements of the Pediatric Triangle.
6. Identify the signs to observe in "appearance."
7. Identify the signs to observe in "work of breathing."
8. Identify the signs to observe in "circulation to the skin."

The Pediatric Triangle image in this module is used with permission from the EMS for Children Resource Alliance.

# Terms

**compensated shock** – An early stage of shock in which the body is able to compensate for inadequate tissue perfusion. It is characterized by tachycardia, decreased skin perfusion and subtle changes in mental status.

**decompensated shock** (decompensation) –a later stage of shock in which the body's compensatory mechanisms break down. The signs include decreased blood pressure, further tachycardia and an altered mental status (agitation, restlessness and confusion).

**NOT SICK** – Assessment category for a pediatric patient who an EMT believes to be *physiologically stable* based on observation of appearance, work of breathing and circulation/skin signs. Other terms for NOT SICK include stable, non-critical and non-urgent.

**shock** – A condition that is caused by inadequate tissue perfusion. It usually develops when the circulatory system is not able to deliver sufficient blood and oxygen to the body organs.

**SICK** – Assessment category for a pediatric patient who an EMT believes to be *physiologically unstable* based on observation of appearance, work of breathing and circulation/skin signs. Other terms for SICK include unstable, critical and urgent.

**sustained tachycardia** – A fast heart rate that is unresponsive to BLS treatment such as warming, oxygen and calming of the patient.

**vasoconstriction** – Constriction of a blood vessel that is caused by the nervous system.

# Anatomy

There are four basic anatomic differences between a child's body and an adult's body that you need to be aware of including:

- Lower blood volume
- Bigger head size
- Softer bones
- Internal organs more vulnerable to injury

A child's **blood volume** is very small when compared to that of an adult. A good rule of thumb is that there is approximately 70 cc of blood present for every 1kg (2 lbs) of body weight. That means a 20 lb child has about 700cc of blood--about the same volume as a large McDonalds soda.

A child's **head size** is proportionally larger than an adult's. This can make spinal immobilization and airway management more difficult. Infants and small children have large occiputs (base of the back of the head) and relatively straight cervical spines. When lying flat a child's cervical spine becomes slightly flexed and the airway can become collapsed and occluded.

Another problem associated with a relatively large head is that infants and small children are prone to flipping or falling over because they are "top heavy." The result is they tend to have more opportunities to receive head trauma. Trauma is a leading cause of death in children older than 1 year of age and head trauma is associated with a majority of the deaths.

A child's **bones** are growing and therefore much softer than an adult's. They can bend more easily.

The **internal organs** of a pediatric patient are not as well-protected and the relative lack of fat and softness of bones in the rib cage make them susceptible to significant internal injuries with very little mechanism or obvious outward signs of injury.

# Shock in Children

Shock is defined as circulatory failure that results in the inadequate delivery of blood to the body's tissues. This lack of blood flow inhibits delivery of oxygen and removal of waste products. Of the several types of shock, hypovolemic shock secondary to blood and body fluid loss is most often seen in children.

In adults, the progression of shock usually includes a **steady reduction in blood pressure** with an accompanying increase in heart rate. By contrast, children maintain blood pressure and cardiac output by increasing heart rate and vasoconstriction, even with a loss of significant volume. A child can lose up to one third of his or her blood volume before a significant drop in blood pressure occurs.

# Signs of Shock

Shock in the pediatric patient always presents in a similar way regardless of whether the cause is blood loss or volume loss due to vomiting or diarrhea. Remember that hypotension is a late sign in pediatric shock.

**Hypotension is a late sign in pediatric shock.**

A hypotensive pediatric patient is one who is approaching cardiac arrest and must be treated aggressively. Never wait for a fall in blood pressure to begin treating for shock.

## Early Signs of Shock

- Sustained tachycardia \*\*\*
- Delayed capillary refill greater than 2 seconds
- Tachypnea
- Anxiousness, combativeness, agitation
- Peripheral constriction, cold clammy extremities

\*\*\* Sustained tachycardia may be the only suggestive finding in many cases of early shock.

## Late Signs of Shock

- Weak or absent peripheral pulses
- Decreased LOC – unconsciousness
- Hypotension (a very late and ominous sign)

# SICK / NOT SICK

It is important that EMTs rapidly distinguish a SICK from a NOT SICK patient. This rapid assessment can have a dramatic impact on a patient's outcome. Although the concept of SICK / NOT SICK is the same regardless of a patient's age—make an initial decision about how to treat your patient early in the call—the clinical indicators are somewhat different in a child.

The SICK child is one who the EMT believes to be physiologically unstable. Physiologic instability is defined as serious abnormality in appearance, work of breathing or circulation to the skin. SICK patients require immediate and aggressive BLS and ALS treatment.

You must quickly recognize the SICK child within the first minute of contact. Much of the information you need to make a decision can be obtained without even touching the patient.

The NOT SICK child is one who you believe to be physiologically stable. These patients have no significant abnormality in appearance, work of breathing or circulation to the skin. These patients do not require immediate ALS intervention but may require an ALS evaluation.

**Make a decision quickly...SICK or NOT SICK**

The most **common mistake** EMTs make when deciding SICK or NOT SICK is waiting for paramedics to arrive to make the decision and begin aggressive care. Another common mistake is failing to recognize and respond to the decompensating patient or the patient who has changed from the NOT SICK to the SICK category.

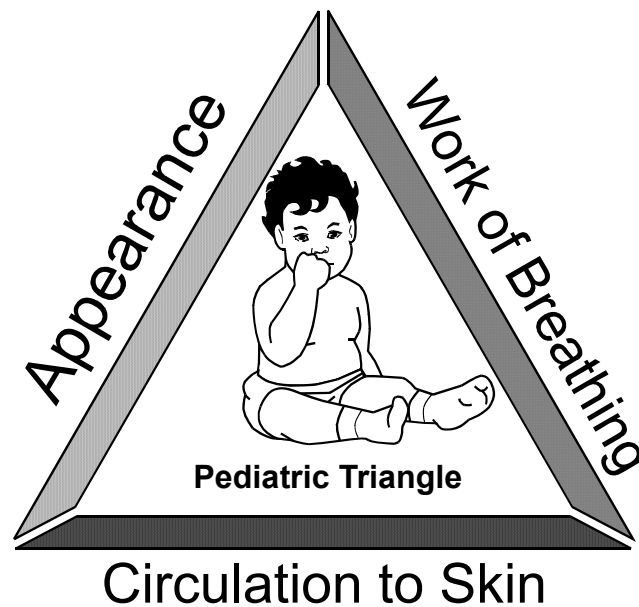


# Pediatric Triangle

There are three key pieces of information that you need to initially assess a pediatric patient including:

- Appearance
- Work of breathing
- Circulation to the skin

You can make a SICK / NOT SICK decision based only on these three signs, in many cases without even touching the patient. These three clinical indicators reflect a child's overall cardiopulmonary status. Together, they are known as the "Pediatric Triangle."



# Appearance

Appearance tells you a lot about oxygenation, brain perfusion and central nervous system function. There are seven components that constitute appearance:

<b>Alertness</b>	How responsive and interactive is the child with a stranger or other changes in environment?  Is she restless, agitated, or listless? Keep in mind that children with mild to moderate illness or injury generally remain alert.
<b>Distractibility</b>	How readily does person, object or sound draw interest or attention?  Will she play with toy or new object?
<b>Consolability</b>	Can she be comforted by the caregiver or responder?
<b>Eye contact</b>	Does the child maintain eye contact with objects or people?  Will she fix her gaze on a face?
<b>Speech/cry</b>	Is the speech/cry strong and spontaneous?  Weak and muffled?  Hoarse?
<b>Spontaneous motor activity</b>	Is she moving and resisting vigorously and spontaneously?  Is there good muscle tone?
<b>Color</b>	Is she pink? Or is he pale, dusky, blue or mottled?  Does the skin coloring of the trunk differ from the extremities?

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You can collect all the information you need about appearance without ever touching the patient. You will find the following appearance-related terms useful in describing the pediatric patient in your short reports and written reports.

- alert
- interactive
- attentive
- playful
- restless
- agitated
- screaming
- consolable by caregiver
- comfortable
- fixes gaze
- maintains good eye contact
- weak cry
- hoarse
- stridorous
- active
- vigorous
- good muscle tone
- limp
- listless
- motionless
- mottled
- dusky
- blue
- pink
- good color

# Work of Breathing

Abnormal position, retractions and audible breath sounds are signs of increased work of breathing and respiratory distress. Watch the child from a distance and observe for these three indicators of increased work of breathing.

A patient in the **sniffing position** is attempting to maximally open his or her airway when an upper airway obstruction is present, for example, in cases of epiglottitis. The patient in the **tripod position** is attempting to recruit all of the muscles of respiration in order to move air in and out of the lungs. The tripod position may be seen in cases of lower and upper airway obstruction and acute respiratory distress. Determine if the child's respiratory effort is normal or if the child appears to be short of breath.

**Retractions** (visible sinking-in of the soft tissues) in the chest wall or neck muscles mean that the child is using greater muscle effort in order to move air.

Wheezing, stridor and grunting indicate problems in either the upper or lower airway.

**Wheezes** are “musical” high-pitched noises often described as a whistling sound. Wheezing is caused by narrowing of the airways due to bronchospasm, edema or foreign matter.

**Stridor** is a harsh, high-pitched sound heard on inspiration without a stethoscope. It is caused by spasms of the larynx and swelling that contract the vocal cords and narrows the opening of the airway. Stridor is common in croup which sounds like the bark of a seal. It may also indicate a life-threatening condition such as epiglottitis or foreign-body obstruction.

**A child with any of the above signs needs  
high flow oxygen and ALS intervention!**

Signs of respiratory failure include **abnormal appearance** and **significant work of breathing**. These tell you that oxygenation or ventilation are inadequate. When you see signs of respiratory distress or significant work of breathing, immediately make the SICK decision and provide aggressive treatment including an ALS response.

You will find the following breathing-related terms useful in describing the pediatric patient in your short reports and written reports.

- apneic
- labored respirations
- retractions (supraclavicular, intercostal, subcostal)
- grunting
- nasal flaring
- poor tidal volume

# Circulation to the Skin

Skin signs are a direct reflection the overall status of the circulatory system. You can assess **skin signs** without laying a hand on the patient. Skin signs include:

- Skin color
- Temperature
- Capillary refill time
- Pulse quality

**Skin color** is an important sign. The body shuts down blood flow to the skin in order to maximize flow to the vital organs in conditions such as shock. The range of abnormal skin colors includes mottled (non-uniform color), pale, grayish and blue. Any of these colors indicate a lack of proper perfusion and/or oxygenation. Normal skin/mucus membrane color should be pink.

**Poor color equals poor circulation.**

**Skin temperature** tells you information about circulatory status. Feel the skin on the child's calf or forearm. Coolness is an early sign of shock.

Check **capillary refill time** (CRT) by blanching (gently compressing until it becomes white) and then releasing a distal extremity such as hand, nail bed or a foot. Normal CRT is **two seconds** or less. Greater CRT may indicate shunting of the blood to the vital organs that occurs with shock.

Check the pulse at the wrist or elbow. If you cannot detect a pulse at either of these sites, it may indicate critically abnormal circulation. The quality of the pulse may be strong, weak or absent.

Vitals signs may be difficult to interpret since pediatric anatomy and physiology vary greatly—heart rates range from 60 to 170 bpm (infant to 12 years), minimum blood pressure ranges from 60 to 94 (infant to 12 years). Carry a reference card with you to determine if vital signs are within normal range for specific age groups.

You will find the following circulation-related terms useful for describing the pediatric patient in your short reports and written reports.

- pulse
- color of skin
- capillary refill time
- heart rate
- blood pressure

Remember, the pediatric patient in shock will maintain blood pressure much longer than an adult. A child can lose up to 1/3 of his or her blood volume before there are any significant changes in blood pressure.

If you wait for blood pressure to drop before treating for shock,  
you have waited too long.

# Treatment (Plan)

EMTs have a variety of treatment options depending on the patient's needs. Crucial steps include: assuring the ABCs and controlling bleeding (remembering to take body substance isolation measures when appropriate). If the patient would benefit from oxygen, for example, if you think shock is possible then administer oxygen therapy.

One important treatment step is deciding if ALS is needed, if not, determining the appropriate transport and destination decisions.

If you do encounter signs of hypovolemic shock, initiate immediate and aggressive treatment to include:

- Trendelenberg position
- High flow oxygen
- Keeping patient warm
- Splinting fractures

## Spinal Immobilization

A special concern when backboarding an infant or small child is avoiding over flexion of the cervical spine. To prevent this problem, fold a towel several times and place it under the child's shoulders. The head should then rest in a neutral position.

